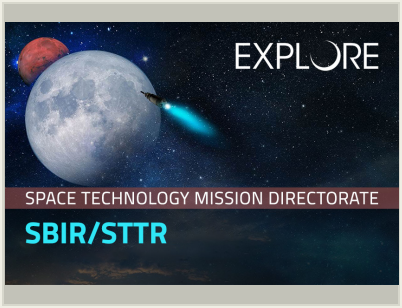
Multi-Point Trilateration: A New Approach for Distributed Metrology, Phase I

Completed Technology Project (2011 - 2011)

Project Introduction

For NASA missions requiring active control of segmented mirrors, optical trusses and booms, coherent, laser-based approaches such as CW laser interferometers have been preferred because they can provide very high resolution relative position measurements. Other approaches, such as multi-color interferometers can provide absolute range measurements. However, neither technique can measure multiple retroreflectors with a single optical transceiver. This has led to complex distributed metrology systems, which are limited in usefulness. Bridger Photonics Inc. proposes to investigate a novel distributed metrology approach that is uniquely enabled by its SLM-Series of actively stabilized swept laser sources. The technique, termed multi-point trilateration, uses a frequency modulated continuous wave (FMCW) chirped laser radar to determine the range to multiple reflectors that are illuminated simultaneously by three or more large field-of-view transceivers. Because Bridger's laser radar system can unambiguously determine the range to multiple targets within the field-of-view with high accuracy, trilateration can be utilized to estimate the three-dimensional (3D) coordinates for all of the retroreflective targets within the field-of-view. Bridger provides two critical advantages for the development of this distributed metrology system: 1) The world's highest resolution laser radar system, which is crucial for determining the range to the multiple retroreflectors, and 2) Proprietary processing techniques that enable Cramer-Rao lower bound limited range estimation. Under the proposed work plan, Bridger will provide an optimal design for Transceiver/Retroreflector geometries and model the expected performance, conduct demonstrations validating the system performance and provide a space-qualifiable, compact system design that can be built and delivered to NASA during a Phase II effort should the approach be feasible.



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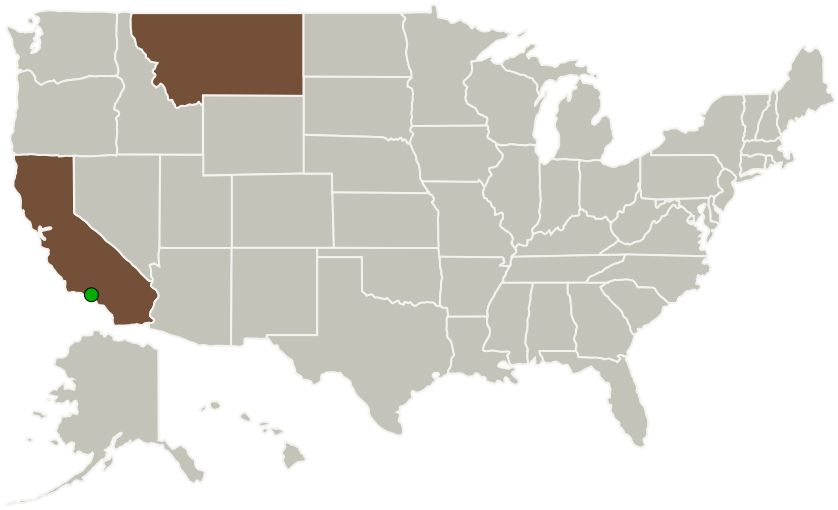
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Bridger Photonics, Inc.	Lead Organization	Industry	Bozeman, Montana
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Montana

Project Transitions

February 2011: Project Start

August 2011: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138336)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Bridger Photonics, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Randy R Reibel

Co-Investigator:

Randy Reibel

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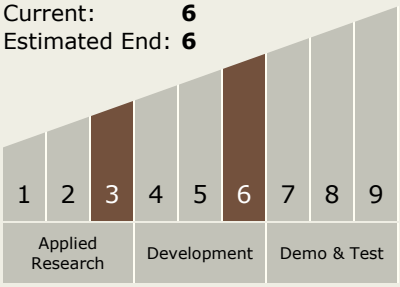
Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.5 Lasers

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System